

and shorter spur one-third of it.

**Gaster:** T1 at apex 0.43x as wide as base, aciculate; T2 length 0.23x length of T1, 0.6x of T3, apical width 3x length, basal width = length; T3 longer than T2, T2 and T3 almost smooth, but sparsely punctate at apex, T3 with a transverse depression basally; remaining tergites smooth and laterally compressed; ovipositor sheath longer than metatarsus, but shorter than hind femora; hypopygium about half as long as abdomen, 0.5x as long as hind tibia, apical and ventral margins, in profile, making an angle of 50°.

MALE: Characters same as that of female.

Metatype FEMALE: INDIA, Kerala, Anakatty, T.C. Narendran, 7.i.1989. Other materials examined: 1 Male, INDIA, Kerala, Neendakara, T.C. Narendran, 22.ii.1987; 1 Male, INDIA, Kerala, C.U. Campus,

T.C. Narendran, 1988. (All specimens deposited in the collections of Department of Zoology, University of Calicut).

**Note:** Apart from the above materials the original Holotype and Paratypes of *Apanteles nilamburensis* Sumodan and Narendran (1990) were also studied.

**Etymology:** *Neoclarkinella*, name derived from *Clarkinella*, owing to the close resemblance of this genus to *Clarkinella* Mason.

#### ACKNOWLEDGEMENTS

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## THE GENUS *MACROCHELES* LATREILLE (ACARINA: MACROCHELIDAE) IN INDIA - ADDITIONAL NEW SPECIES AND NEW RECORDS ASSOCIATED WITH DUNG BEETLES (COLEOPTERA: SCARABAEIDAE) FROM SOUTH INDIA<sup>1</sup>

RANJIT KUMAR ROY<sup>2</sup>

(With sixteen text-figures)

Additional new species of insecticolous *Macrocheles*, namely *M. erichsonii* and *M. quadrilineatus* are described from South India. In addition, the paper presents further distributional records for *M. malabaricus* Evans & Hyatt, *M. nevernalis* Evans & Hyatt, *M. ceylonicus* Evans & Hyatt from Peninsular India.

#### INTRODUCTION

In part IV of the series (Roy 1994a), two new species of insecticolous *Macrocheles*, namely *M. punctovariata* and *M. sisiri* were described from

Karnataka. The present contribution describes two more new species from South India. The present paper is based on material recovered from dung beetles collected from Andhra Pradesh, Karnataka, Kerala and Tamil Nadu. In addition to the description of two new species (*M. erichsonii* and *M. quadrilineatus*), the paper gives new distributional records for *M. malabaricus*, *M. nevernalis* and *M. ceylonicus* described by Evans and Hyatt (1963).

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*M. malabaricus*, earlier known only from Malabar, has been recorded from Andhra Pradesh, Karnataka, Kerala and Tamil Nadu. While the other two species, initially known to be distributed only in Tamil Nadu, are now found in the other southern states as well.

The collections were made on three field collecting trips undertaken by me during 1980, 1988 and 1992.

An earlier publication in the series (Roy 1994a) was based on the examination of 7 specimens of *Heliocopris* sp.1 revealing *M. punctovariata*, a new species (total 8 females and a male recovered), and 10 specimens of *Copris* sp.1 revealing the second new species, namely *M. sisiri* (total 19 females recovered). Seventeen specimens of beetle material utilised in the study were also part of the total collection of beetles harbouring macrochelid mites during the present course of study.

The beetles were usually collected under street lights after 9 p.m., till midnight and also from dairy farms using a petromax lantern as the source of illumination to attract beetles and also by laying traps baited with dung in the vicinity of cattle sheds.

Four hundred and two coprid beetles were collected during the field trips. Mites belonging to six families were represented, namely the Macrochelidae, Pachylaelapidae, Eviphididae, Parasitidae, Uropodidae and Ascidae. The family Macrochelidae was found on 302 beetles, either exclusively or with phoretic non-macrochelid mites. Another 68 beetles harboured only non-macrochelid mites and the remaining beetles carried no mites. *Macrocheles* fauna recovered from 133 beetle specimens (material comprising 18 species of Coprid beetles) out of the total collection of 302 beetles is being presented in this series. The other macrochelid genera represented in the material are *Neopodocinum* Oudemans and *Glyptholaspis* Filipponi & Pegazzano. The former genus was recorded earlier (Roy 1994b) in a preliminary report and the latter genus was treated in an earlier publication (Roy 1988). Additional information now available on both the genera, together with information following completion of the unexamined material on the family Macrochelidae would be dealt with in subsequent

publications.

In recent years, the largest study on phoretic *Macrocheles* associated with dung beetles was conducted by Wallace (1986) in Australia. The study was based on the examination of a large collection of beetles maintained in the Australian National Insect Collection (ANIC) housed at Commonwealth Scientific and Industrial Research Organisation (CSIRO), Division of Entomology, Canberra and nine species of *Macrocheles* phoretic on dung beetles were reported by Wallace (loc. cit.). Bhat *et al.* (1983) reported two adult females of *Nothrolaspis* sp. recovered from *Rattus rattus gangutrianus* and *Suncus murinus* from India. Berlese (1918) erected the genus *Nothrolaspis* and it was included in the family Macrochelidae by Vitzthum (1930). The genus is no longer valid and it has been synonymised with the genus *Macrocheles* by Evans & Browning (1956) comprising the largest number of species among mesostigmatids. Bhat *et al.* (loc. cit.) also collected nymphs of *Nothrolaspis* sp. from man (probably the only record), cattle sheds, chicken coops and *Rattus rattus gangutrianus* from the states of Himachal Pradesh, Uttar Pradesh and Sikkim. The female specimens collected by them may be members of the *glaber* group (unpublished research data under preparation) and they occasionally become phoretic on insects (beetles and synanthropic flies) and often on vertebrates. Nymphs excluding the genus *Neopodocinum* among the Macrochelidae are non-phoretic. Pending examination of the material collected by Bhat *et al.*, the identity of the specimens remain doubtful.

Phoresy is a form of commensalism, an association evolved between forms capable of fast movement (insects and vertebrates) and others (mites and nematodes) lacking that capability, through co-sharing a common habitat — the latter forms exploit the former to their advantage for quick dispersal in search of a suitable habitat when adverse conditions threaten their survival in a particular habitat. Adaptive trends towards a phoretic mode of life are seen among members of the genus *Macrocheles* accompanied by cheliceral modification for grasping the host body (Evans and Hyatt 1963) as well as



reduction in the size of the ventral shields together with the degeneration of sclerotisation to reduce body weight in the true phoretic forms, in contrast to the members that only occasionally become phoretic (Unspecialised phoresy). *Scarabaeus* sp.1 with *M. perglaber* Fil & Pegg, grasping bristles around the mouth parts of the beetle, together with soil nematodes phoretic on the mite has been collected on two occasions from light traps at Dibrugarh during the present study.

The primary aim of the study is to provide information on biological resources associated with various types of dung, which would be the essential prerequisite to stimulate applied research focussing attention on other biological parameters like feeding habits, food preferences and behavioural relationships among the dung dwellers leading to the evaluation of their possibility as biological control agents. In the developed countries the trend of applied acarological research has been directed towards the goal of controlling synanthropic flies by employing some species of *Macrocheles* occurring in dung with considerable success. In recent years in Malaysia studies aiming at similar objectives have been initiated by Ho and Ismail (1988,1990); Ho (1990) and Ho and Auemetua (1990).

The material is in my collection. Measurements cited in the text are in micrometres.

#### METHODS

Mites were recovered from beetle hosts using a fine brush or often with a needle and placed in lactophenol, which was then heated until the mites were clean enough for microscopic examination. Mites were usually found lodged around coxal cavities, mouth parts and under the elytrae. Camera lucida drawings were prepared from temporary mounts. Tarsus II of female was drawn in *situ*. Chelicerae of both sexes, legs II and IV of male were dissected for illustrations. Heinze-PVA mounting medium was used for mounting the types and the dissected parts on slides. The other specimens, after microscopic study, were preserved in 70% alcohol.

#### DESCRIPTION OF SPECIES

##### 1. *Macrocheles erichsonii* sp. nov.

FEMALE (Figs. 1-5): Dorsal shield (Fig. 1) 606-652 long, 333-348 wide, faintly reticulate. Vertical setae, (j1) distally plumose, their bases almost contiguous, setae j4, z4, Z3, Z4, S5 and Z5 distally plumose; other dorsal setae pointed and simple. Extra-marginal setae simple.

Sternal shield (Fig. 2) granulated throughout and covered with punctures; *l. m. t.* and *l. ang.* present; sternal setae smooth. Metasternal shields each with a simple seta. Genital shield ornamented with punctate lines, genital setae smooth at posterolateral corners. Ventrianal shield 182-212 long, 182-197 wide, ornamented with punctate transverse lines; ventrianal setae fairly long and smooth.

Gnathosoma with five rows of deutosternal denticles. Tectum as shown in Fig. 3. Both movable and fixed digit of chelicera (Fig. 4) bidentate; cheliceral brush more than half the length of movable digit.

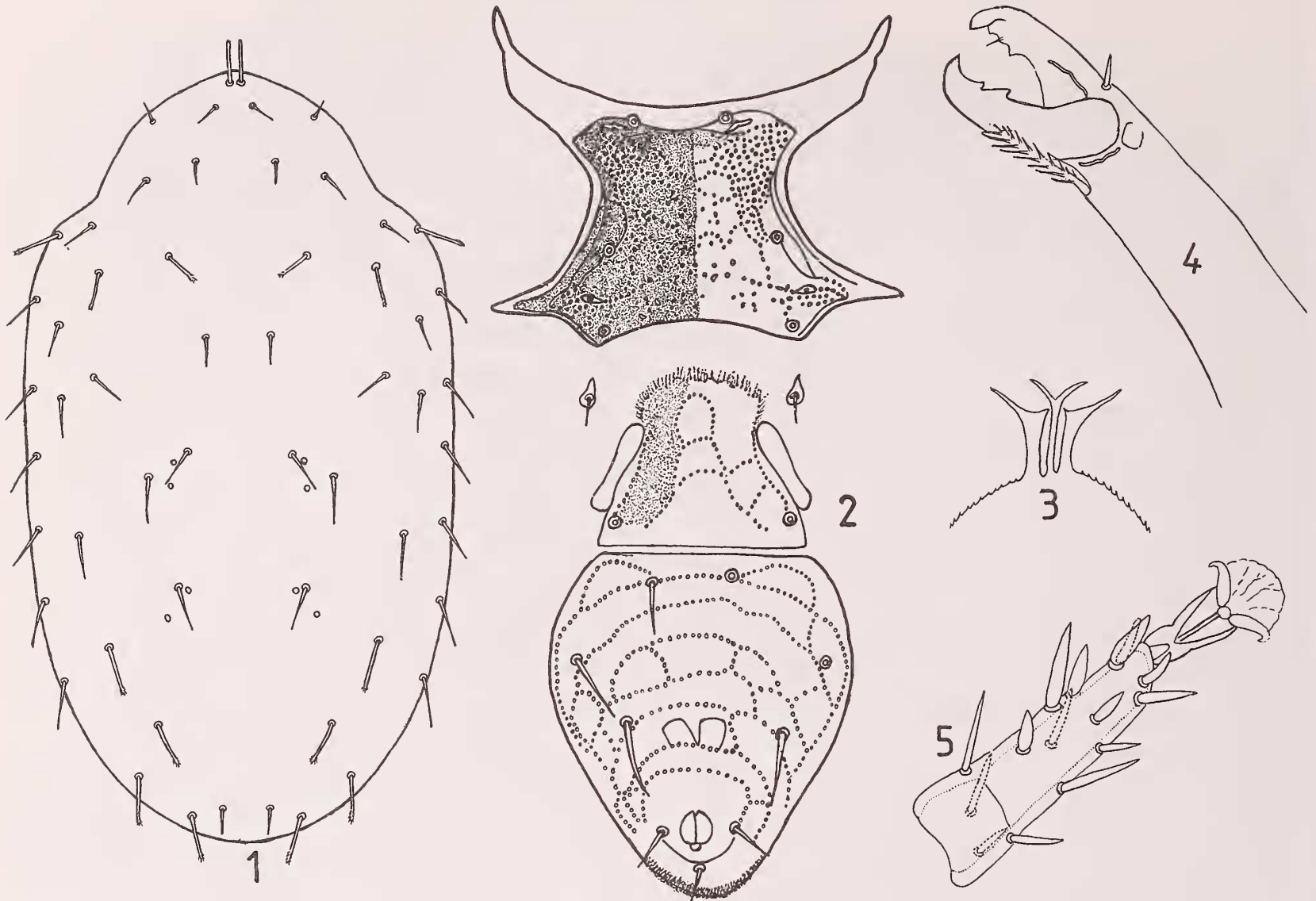
Approximate lengths of legs (excluding pretarsi): I-424; II-303; III-288; IV-424. Tarsus I (90) longer than tibia I (75), Tarsus II (Fig. 5) 106; tibia II-75. Genu IV with six simple setae.

MALE (Figs. 6-11). Dorsal shield (Fig. 6) 530-575 long, 288-333 wide, ornamentation as in female, attenuated posteriorly and bearing 30 pairs of setae. Setae j1, j4, z4, r3, Z4, j5, S5 and Z5 pilose.

Genital orifice presternal in position. Sternitigenital shield (Fig. 7) 227 long, 121-136 wide, non-reticulate and with five pairs of simple setae. Ventrianal shield (Fig.7) 166-197 long, 152-182 wide, devoid of reticulation and with 9 simple setae.

Gnathosoma as in female. Tectum as shown in Fig. 8. Chelicera (Fig. 9) with movable digit unidentate; fixed digit bidentate; spermatophoral process long; cheliceral brush two-thirds of movable digit.

Approximate lengths of legs (excluding pretarsi): I-439; II-318; III-242; IV-424. Femur II



Figs. 1-5: *Macrocheles erichsonii* sp. nov. Female: Fig. 1. Dorsal Shield; Fig. 2. Venter; Fig. 3. Tectum; Fig. 4. Chelicera; Fig. 5. Tarsus II.

(Fig. 10) with a prominent lateral spur; tarsus II with a protuberance (Fig. 10); trochanter and femur IV (Fig. 11) spurred; tarsus IV (Fig. 11) with a protuberance.

**Material Examined:** *Holotype*: FEMALE, INDIA: Andhra Pradesh: Arku Valley, 20.iii.1980, ex *Scarabaeus erichsoni* Harold; *Allotype* male, Tamil Nadu: Coimbatore, Tamil Nadu Agricultural University Campus, Central Dairy Farm, 13.iii.1980, ex manure heaps; *Paratypes*: 1 female, Coimbatore, near Central market, 16.ii.1992, ex *Onthophagus orientalis* Harold; 2 females, Nilgiri Hills, Ootacamund, Botanical Garden, 18.ii.1992, ex *O. orientalis*; 1 female, Nilgiri Hills; Pykara, village area, 19.ii.1992, ex *Catharsius molossus* L.; 3 males, Coimbatore, TNAU Campus, Central Dairy Farm, 13.iii.1980, ex manure heaps; 6 females, Nagercoil, 3.iii.1992, ex *Scarabaeus erichsoni*; 2 females,

Madras, Deer Park, 15.iii.1992, ex *Scarabaeus erichsoni*; 3 females, Andhra Pradesh: Visakhapatnam, cattle shed near Andhra University campus, 30.iii.1992, ex *Scarabaeus brahminus* Cast; 2 females, Karnataka: Mysore, Zoo Garden, 16.iii.1980, ex *Gymnopleurus maculosus* McLeay; 1 female, Bangalore, Nandi Hills, 10.viii.1988, ex *Copris spinator* Harold; 2 females, Kerala: Trivandrum, outskirts of Rly. Station, 2.iii.1992, ex *Catharsius granulatus* Sharp.

**Distribution:** INDIA: Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

**Remarks:** *Macrocheles erichsonii* is close to *M. robustulus* (Berlese) in respect of punctate ornamentation of the sternal shield and also in dorsal chaetotaxy. *M. robustulus* has been redescribed as *Macrocheles punctillatus* Willmann, 1939 by Bregetova and Koroleva (1960) and as *M.*



*rothamstedensis* by Evans and Browning (1956). Costa (1966) also illustrated the species. Setae j1, j4, z4, r2, S5, Z5 and Z3-4 are plumose in *erichsonii*. Plumose nature of setae may vary; seta z2 plumose as illustrated by Evans and Browning (Fig. 14, p. 15, 1956); z2 being simple as shown by Costa (1967), Bregetova and Koroleva (1960); the seta is simple in the present species. The sternal shield in *erichsonii* is finely granular and *l. ang.* and *l. o. p.* discernible, even though formed by punctures, but in *robustus* these *liniae* are not discernible as illustrated by Bregetova and Koroleva (Fig. 91, p. 127, 1960). Besides the shape and ornamentation of the ventrianal shield of *robustus* figured by Bregetova and Koroleva is also different. The occurrence of this species in manure heaps was reported by Axtell (1961), Costa (1967). Ridsdill Smith and Hull (1984) recorded a good collection of *M. robustulus* in dung baited pitfall traps in Western Australia. This species could not be located on any of the dung beetles or from manure heaps during the present study. *M. erichsonii* belongs to *robustus* group for its affinities with *M. robustulus*.

## 2. *Macrocheles quadrilineatus* sp. nov.

FEMALE (Figs. 12-16) : Dorsal shield (Fig. 12)

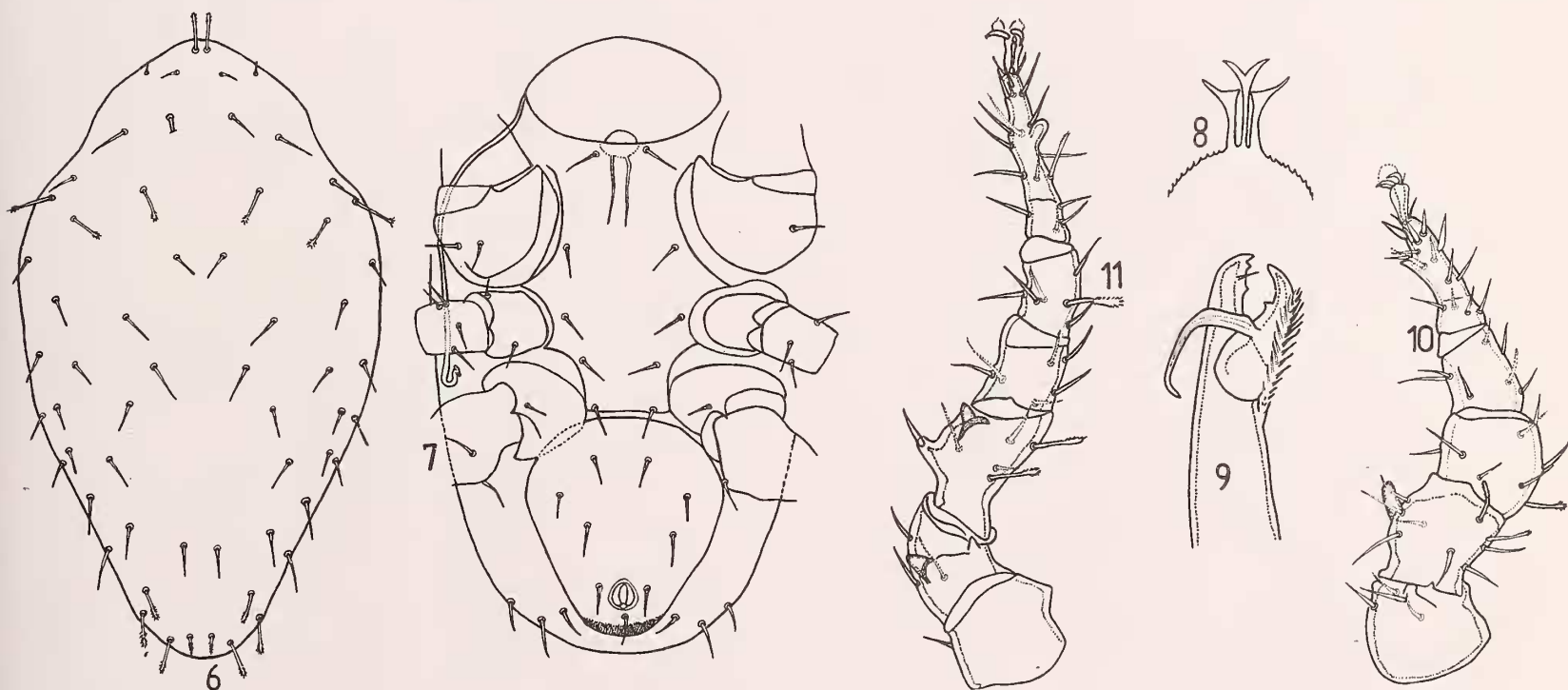
500-600 long, 315-345 wide, reticulate and bearing 28 pairs of simple setae, insertions of verticals adjacent.

Sternal shield (Fig. 13) granular, *l.o.p.* extending almost to the centre of the shield; *l.o.a.* also distinct, *l. arc.* and *l.a.t.* well-marked; sternal setae smooth.

Metasternal shields elongate, each with a simple seta, subequal to sternals. Genital shield granular, truncated posteriorly, ornamented with punctate lines along accessory sclerites and a medial punctate line in the form of an inverted 'U'; genital setae smooth. Ventrianal shield 165-180 long, 150 wide, finely granular, subtriangular, ornamented with faint transverse lines; ventrianal setae in most of the specimens lost. Metapodal shields as usual, close to the coxae IV. Ventrolateral integument striate, integumental setae short and simple. Stigmata typical of genus, peritremes each terminating anterodorsally to a median point between insertions of j1 and z1.

Gnathosoma with five rows of deutosternal denticles. Tectum as illustrated in Fig. 14. Chelicera as shown in Fig. 15. Cheliceral brush more than half the length of the movable digit.

Approximate lengths of legs (excluding



Figs.6-11: *Macrocheles erichsonii* sp. nov. Male: Fig.6. Dorsal Shield; Fig.7. Venter; Fig.8. Tectum; Fig.9. Chelicera; Fig.10. Trochanter, femur, genu, tibia and tarsus of leg II. Fig.11. Coxa, trochanter, femur, genu, tibia and tarsus of leg IV.

pretarsi): I-315; II-375; III-300; IV-450. Tarsus I (90) longer than tibia I (60). Tarsus II (Fig. 16) (90); tibia II (60). Genu IV with six simple setae.

MALE: Unknown.

**Material Examined:** *Holotype:* FEMALE: INDIA: Karnataka: Mysore, Zoo Garden, 16.iii.1980, ex *Scarabaeus brahminus*; *Paratypes:* 5 females collection data as that of holotype; 5 females, Tamil Nadu: Nagercoil, 3.iii.1992, ex *Heliocopris midas* (F.); 4 females, Tirunelveli, 11.iii.1992, ex *Heliocopris bucephalus* (F.); 4 females, Kanyakumari, 4.iii.1992, ex *Gymnopleurus maculosus* McLeay; 2 females, Tirunelveli, 11.iii.1992, ex *Onitis singhalensis* Lansb.

**Distribution:** INDIA: Karnataka and Tamil Nadu.

**Remarks:** Setae of both dorsal and ventral shields in most of the specimens were lost. Altogether 21 specimens could be recovered from beetle hosts on which this description has been based.

3. *Macrocheles malabaricus* Evans & Hyatt  
*Macrocheles malabaricus* Evans and Hyatt, 1963, *Bull. Brit. Mus. (Nat. Hist.)* 9(9): 354.

**Material examined:** 1 female, Andhra Pradesh: Guntur, 19.iii.1992, ex *Heliocopris bucephalus*; 2 females, Vijaywada, 18.iii.1992, ex *Heliocopris bucephalus*; 2 females, Eluru, 17.iii.1992, ex *Heliocopris dominus* Bates; 2 females, Karnataka: Gundelpet, 15.ii.1992, ex *Catharsius molossus* L.; 3 females, Bangalore, GKVK campus, 10.viii.1988, ex *Heliocopris dominus*; 2 females, Bangalore, IISc campus, 11.viii.1988, ex *Onitis singhalensis* Lansb; 4 females, Bangalore, Krishnarajapuram, 11.viii.1988, ex *Onitis subopacus* Arrow; 1 female, Bangalore, Nandi hills, 10.viii.1988, ex *Onitis philemon*; 6 females, Bangalore, Golap Bagh, 12.viii.1988, ex *Copris* sp.2; 1 female, Kerala: Quilon, 1.iii.1992, ex *Catharsius granulatus* Sharp; 1 female, Trivandrum, Kerala University campus, 2.iii.1992, ex *Onthophagus cervus* (F.); 3 females, Palghat, 14.iii.1980, ex *O. unifasciatus* F.; 2 females, Tamil Nadu: Coimbatore, TNAU campus, Dairy Farm, 13.iii.1980, ex *O. unifasciatus*; 4 females, Ootacamund, Botanical Garden, 18.ii.1992, ex *O.*

*orientalis*; 1 female, Kodaikanal, Bryant Park, 12.iii.1980, ex *O. orientalis*; 2 females Rameswaram, 7.iii.1992, ex *O. cervus* (F.); 1 female, Pamban area, 7.iii.1992, ex *Onitis philemon*; 3 females Dhanushkodi, 8.iii.1992, ex *Onitis singhalensis* Lansb.

**Distribution:** INDIA: Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

**Remarks:** Evans and Hyatt (1963) described this species based on a single female off *Gymnopleurus maculosus* McLeay in the collections of the British Museum (Natural History), London. Since 1963, this is the first record of the species from south India. The species seems to be distributed only in peninsular India.

4. *Macrocheles nevernalis* Evans & Hyatt  
*Macrocheles nevernalis* Evans & Hyatt, 1963, *Bull. Brit. Mus. (Nat. Hist.)* 9(9): 361.

**Material examined:** 1 female, Andhra Pradesh: Guntur, 19.iii.1992, ex *Oniticellus* sp.1; 4 females, Vijaywada, 18.iii.1992, ex *Onitis philemon*; 3 females, Visakhapatnam, cattle shed near Andhra University campus, 30.iii.1992, ex *Copris* sp.2; 4 females, Karnataka: Bangalore, Golap Bagh, 12.viii.1988, ex *Copris spinator*; 3 females, Bangalore, Nandi Hills, 10.viii.1988, ex *Catharsius molossus*; 4 females, Kerala: Trivandrum, Kerala University campus, 2.iii.1992, ex *Onthophagus orientalis*; 5 females, Tamil Nadu: Arkonam, 13.iii.1992, ex *Scarabaeus erichsoni*.

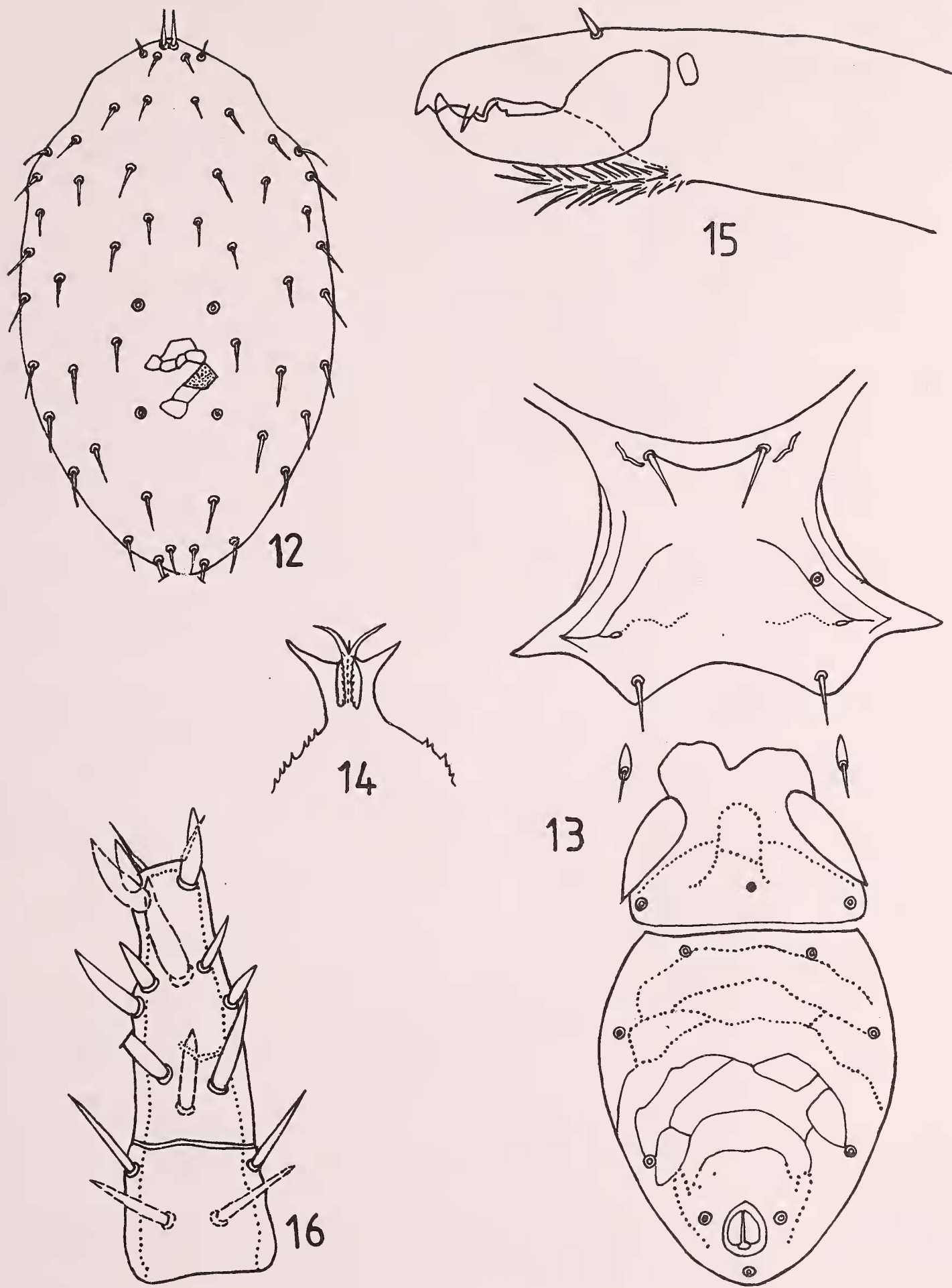
**Distribution:** INDIA: Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

**Remarks:** Evans and Hyatt's (1963) description of *nevernalis* was based on 4 females collected ex *Scarabaeus brahminus* cast at Namakal, Salem, Tamil Nadu.

5. *Macrocheles ceylonicus* Evans & Hyatt  
*Macrocheles ceylonicus* Evans & Hyatt, 1963, *Bull. Brit. Mus. (Nat. Hist.)* 9(9): 341.

**Material Examined:** 1 female, Andhra Pradesh: Rajahmundry, 20.iii.1992, ex *Scarabaeus erichsoni*; 7 females Rajahmundry, 22.iii.1992, ex *Scarabaeus* sp.1; 1 female, Gudur, 11.iii.1992, ex *Copris* sp. 2; 4 females, Karnataka: Gundelpet, 15.ii.1992, ex *Catharsius molossus*; 1 female,





Figs.12-16. *Macrocheles quadrilineatus* sp. nov. Female: Fig.12 Dorsal Shield; Fig.13. Venter; Fig.14. Tectum; Fig.15. Chelicera; Fig.16. Tarsus II.

Kerala: Quilon, 1.iii.1992, ex *Catharsius molossus*; 4 females, Tamil Nadu: Kodaikanal, Bryant Park, 12.iii.1980, ex *Scarabaeus brahminus*; 6 females, Rameswaram, 7.iii.1992, ex *Onthophagus orientalis*; 5 females, Pamban area, 7.iii.1992, ex *Onthophagus unifasciatus*.

TABLE I

LIST OF KNOWN BEETLE HOSTS FOR *M. erichsonii* SP. NOV., *M. quadrilineatus* SP. NOV., *M. malabaricus* EVANS & HYATT, *M. nevernalis* EVANS & HYATT, AND *M. ceylonicus* EVANS & HYATT

<i>M. erichsonii</i> (female only),		Male nonphoretic
Beetle host	Number of Collections	
<i>Scarabaens erichsoni</i>	9	
<i>Scarabaens brahminus</i>	3	
<i>Copris spinator</i>	1	
<i>Catharsius molossus</i>	3	
<i>Catharsius granulatus</i>	1	
<i>Gymnopleurus maculosus</i>	1	
<i>Onthophagus orientalis</i>	3	
Total hosts: 7	Total Collections:	21

*M. quadrilineatus* (Female only)

Beetle host	Number of Collections
<i>Scarabaens brahminus</i>	6
<i>Heliocopris midas</i>	5
<i>Heliocopris bucephalus</i>	4
<i>Gymnopleurus maculosus</i>	4
<i>Onitis singhalensis</i>	2
Total hosts: 5	Total Collections: 21

*M. malabaricus* (Female only)

Beetle host	Number of Collections
<i>Catharsius molossus</i>	2
<i>Catharsius granulatus</i>	1
<i>Copris</i> sp. 2	6
<i>Heliocopris bucephalus</i>	2
<i>Heliocopris dominus</i>	5
<i>Onthophagus cervus</i>	3
<i>Onthophagus orientalis</i>	4
<i>Onthophagus unifasciatus</i>	5
<i>Onitis philemon</i>	2
<i>Onitis singhalensis</i>	5
<i>Onitis subopacns</i>	4
Total hosts: 11	Total Collections: 39

*M. nevernalis* (Female only)

Beetle host	Number of Collections
<i>Catharsius molossus</i>	3
<i>Copris spinator</i>	4
<i>Copris</i> sp. 2	5
<i>Onthophagus orientalis</i>	4
<i>Oniticellus</i> sp. 1	1
<i>Onitis philemon</i>	4
<i>Scarabaeus erichsoni</i>	5
Total hosts: 7	Total Collections: 26

*M. ceylonicus* (Female only)

Beetle host	Number of Collections
<i>Catharsius molossus</i>	4
<i>Copris</i> sp. 2	1
<i>Onthophagus orientalis</i>	6
<i>Onthophagus unifasciatus</i>	5
<i>Scarabaens erichsoni</i>	1
<i>Scarabaens brahminus</i>	2
<i>Scarabaeus</i> sp. 1	7
Total hosts: 7	Total Collections: 26

**Distribution:** SRI LANKA and INDIA: Andhra Pradesh, Kerala and Tamil Nadu.

**Remarks:** *Macrocheles ceylonicus* was described by Evans and Hyatt (1963) based on 3 females collected ex *Scarabaeus erichsoni* at Colombo, Sri Lanka and six females recovered from the same host collected from Madras.

## DISCUSSION

Table I presents a list of beetle hosts comprising 18 species of dung beetles totalling 133 specimens as the source material for the present communication. Two species of beetle hosts represented by a collection of 17 specimens were utilised in Part IV of the series. Altogether seven species of phoretic *Macrocheles* (4 new species and three earlier known species) have been recovered from 20 species of beetle hosts (Total number of specimens 150) from southern India. *M. punctovariata* (Roy) and *M. sisiri* (Roy) are unrepresented in the present material.



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